SAVONIA
ammattikorkeakoulu

OPINNÄYTETYÖ - AMMATTIKORKEAKOULUTUTKINTO
KULTTUURIALA

COOL ACCESSIBILITY

Inclusivity in Industrial Design

TEKIJÄ/T Juha-Matti Puljujärvi

OPINNÄYTETYÖ - AMMATTIKORKEAKOULUTUTKINTO - KULTTUURIALA

Cool Accessibility
Inclusivity in Industrial Design

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SUMMARY

In the thesis a product design for a design competition “Huld Design Award 2023” was created and retrospectively analyzed. The theme of the competition was “Cool Accessibility”. The final product design was a shelving system for wheelchair users, which was implemented with moving shelves.

The theory phase has information about accessibility, and its connections to closely related subjects like usability is reviewed. A great emphasis is put on the information that affects the design process for special needs groups and especially wheelchair users. Next the used design tools, ideation techniques and processes are introduced. Lastly design research tools are shown with emphasis on open interviews.

The project phase starts with open interviews from three wheelchair users and a Master of Education who works with wheelchair users. After the interviews the project advances to the larger information research phase after which the use of design tools starts. The project development starts with brainstorming and quickly transcends into the iterative design process. The design concept takes shape, and the materials sent to the competition are unveiled.

After the finalizing of the concept, the retrospective analysis of the project and the finalized concept starts. Viewpoints of both, the creator of the concept and the interviewed wheelchair users are present. The analyzation will finally take shape as a four-stage list of aspects that should be taken into accord when designing for special needs groups like wheelchair users.

The final part of the thesis has retrospection on the thesis process itself and about the personal growth as a professional designer.

Culture

Degree Programme in Design

Juha-Matti Puljujärvi

Cool Accessibility:
Inclusivity in Industrial Design

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30. April. 2024

50/1 pages

#Design #Accessibility #Wheelchairs

TIIVISTELMÄ

Opinnäytetyössä toteutetaan teollisen muotoilun tuote ”Huld Design Award 2023” -muotoilukilpailuun. Toteutettua tarkastellaan retrospektiivisestä näkökulmasta. Kilpailun aiheena oli ”Cool Accessibility”. Toteutettu tuote oli karusellin tapaisesti hyllyjä pyörittävä hyllysysteemi pyörätuolinkäyttäjille.

Opinnäytetyön teoriaosuudessa tutustutaan esteettömyyteen ja siihen minkälaisia konsepteja siihen linkittyy. Suuri painoarvo on asetettu tiedolle, joka ohjaa erityisryhmille ja/tai jonkinlaisen vamman omaaville suunnittelemiseen. Teoriaosuudessa tarkastellaan myös perinteisiä muotoilun työkaluja, prosesseja sekä ideointimenetelmiä. Viimeisenä tuodaan esille tiedonhankintakeinoja, joista keskitytään pääasiallisesti avoimeen haastatteluun.

Projektiosuuden läpikäynti aloitetaan haastatteluista, joissa haastateltiin kolmea pyörätuolinkäyttäjää sekä yhtä kasvatustieteiden maisteria. Haastatteluista projekti etenee muuhun tiedonhankintaan, minkä jälkeen aloitetaan muotoilun työkalujen soveltaminen. Kehitystyö aloitetaan aivoriihellä, mistä edistytään iteratiiviseen muotoilutyöhön. Design konsepti saa muotonsa. Kilpailuun lähetetty esittelymateriaali esitellään.

Designin valmistuttua aletaan sitä tarkastelemaan retrospektiivisestä näkökulmasta käsin. Sekä omakohtainen kokemus että haastateltujen palaute prosessista sekä konseptista käydään läpi. Tarkastelun jälkeen on koottu neljän kohdan lista siitä, mitä erityisryhmille, kuten pyörätuolinkäyttäjille, suunnitellessa tulisi ottaa huomioon.

Opinnäytetyön loppuun on sijoitettu retrospektiivi koskien opinnäytetyöprosessia sekä omakohtaista kasvua muotoilun ammattilaisena.

Kulttuuri

Muotoilun koulutusohjelma

Juha-Matti Puljujärvi

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30. huhtikuuta. 2024

50/1 sivua

#Design #Esteettömyys #Pyörätuoli

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1. INTRODUCTION

In this thesis, an industrial design concept was created and retrospectively analyzed. The design was aimed to be an innovation in the field of accessibility, with a major interest in human-centered design approach. It was designed to fit to the guidelines of Huld's competition "Huld Design Awards 2023". The theme of the competition was Cool Accessibility.

The first section of the thesis focuses on theory about what is accessibility, the main theme of the competition and the core element of the created design. Accessibility will be examined from a few different viewpoints: what exactly is it, what could hinder individual's accessibility. This is scaled to a few causes that are necessary for the thesis, as there are unlimited number of different causes that could hamper with one's ability to have accessibility. The last part of the first section will go through what is accessible design, what elements is it constructed from and how do different design views, meaningful or inclusive for example, compare with each other and how do they see issues of accessibility differently. Thesis does not pay attention to the accessibility of networks or sites, but only to the accessibility of the physical world.

After introducing some theory of what accessible design is, the thesis has information about the design elements a project like this should take into account and has a more accurate look on some of the main elements and techniques designers could utilize to end up with a good design. As with the previous section, the examined elements are kept to the relevant ones.

The chapter also reviews what are interviews and how they fit a design process. A main interest is on the open interviews, as it is the most consequential for the design process at hand. With interviews, the theory part of the thesis is finished, after which starts the description of the design process.

The fourth chapter illustrates the design process taken, and focuses on the iterations made into the design during the project. The chapter will illuminate why a decision was made to design for people in wheelchairs and how it guided the project. The different parts of the project are present, and the whole project is presented in mostly chronological manner. The project chapter ends with a look on the materials send to the competition's judges.

The second to last chapter will reflect on what was created during the process. The product was retrospectively analyzed from different viewpoints, main interest in the questions of what aspects of it work and what do not. To keep the chapter somewhat objective, the project's three interviewees were asked to give their feedback on the process and on the end results it created. After the retrospective, it was analyzed what one should do in the future in similar design projects and how could one keep the positive elements of the current process but correct what's lacking. The thesis will end with a personal retrospective on professional growth and learning.

Even though Savonia's design theses are mainly in Finnish, there were various reasons why it was decided that this thesis would be created in English. Firstly, the competition in the core of the thesis was in English. Secondly, during education mainly Finnish design terms have been used. Granted, Finnish uses a lot of the English terms especially with more modern aspects of design. The materials on the subject matter are also more plentiful. The focus has been given to published books as source materials, but online sources are used as needed.

1.1 HULD DESIGN AWARDS 2023

A design competition held by Huld between the dates of 18.1.2023 and 30.4.2023 aimed at design students in Finland – with an objective to have an idea that would make everyday life easier for everyone. Both new product designs and service concepts were welcome. (Havusto 2023.)

Huld partnered with Kone for the competition. Kone is best known for their elevators and escalators, but they also provide automatic doors as well as solutions for maintenance and modernization to buildings. (Havusto 2023.)

The theme for the competition was '2030: Cool Accessibility'. As stated in the kick-off guide, what they wanted was "Cool Accessibility that is appealing, responsible, socially just and economically viable." That meant the design should be empowering, but desirable for everyone at the same time, it should use technologies existing in the near future, be easy to manufacture, and be somewhat connected to Kone and People Flow. The important keywords were desirability, feasibility, and viability. (Huld 2023.)

The competition was won by a group of students from University of Lapland with an idea that had strong ties to the Kone's People Flow. Their idea "Latu", as described, would be a navigation service for large buildings (shopping malls, airports) that would show the optimal route, as well as elevators and escalators. (University of Lapland 2023.)

The second and third place winners were pairs of students from Metropolia. The third placement's concept idea "Leni" was an active noise cancelling speaker designed for public places. It was designed to be applicable to many different locations, and their focus group was noise-sensitive individuals. What felt the most important from what they told about their project, was that they interviewed their neurodivergent friend for information about the field. (Design Metropolia 2023.) *This ties heavily to the conclusion this thesis ends with. One should not design for a target group, without consulting at least one member of the said group.*

FIGURE 1. LOGO OF KONE (KONE.)

FIGURE 2. LOGO OF HULD (HULD.)

2. ACCESSIBILITY

Accessibility has many different meanings depending on the context: it can refer either to accessibility in the properties of the digital design, or the accessibility that refers to the movement limitations in the physical world. These are only narrow viewpoints to the matter that is accessibility, and the real meaning behind the term is empowerment and equality. (Duggin 2016.)

Accessibility is highly dependent on the situation. It is not something that is or is not: it depends on the abilities of an individual and the scenarios they face. People have a wide range of abilities and that affects what one can find accessible. (Duggin 2016.)

In this thesis, the term accessibility will refer mainly to the struggles of the physical realm, as the aim is to create an industrial product design as opposed to a digital one. This will limit the potential concepts to some degree but serve as a core element for the project.

2.1 USABILITY

Usability describes how a product helps to achieve goals effectively, efficiently, and pleasantly. (Väyrynen, Nevala & Päivinen 2004, 17). The usability of a system decreases as the flexibility increases. One example of this is the Swiss Army Knife. It has increased flexibility, but the tools together are less usable compared to simple single tools. Creating usable products with less flexibility is preferred when a specific need is known. (Lidwell, Holden & Butler 2010, 102-103.)

Aesthetic designs appear to be more usable than those that are not, even when that is not the case. It is important to make aesthetic designs, as they are more readily accepted and used over time. (Lidwell, et al. 2010, 20-21.)

The form follows function's prescriptive interpretation claims that in design the aesthetics are secondary to functionality. The question of "What aspects of the design are critical to success?" should be considered. It should not be taken as a strict design rule, but as an aesthetic guide. (Lidwell, et al. 2010, 106-107.)

2.2 DISABILITIES

In her book Designing Disability, Guffey (2018, 5-6) tells about the thought experiment that Victor Finkelstein presented in 1975. It was about a village, where wheelchair users were the norm, and able-bodied were the minority that needed helping solutions from the society. As the society was structured to fit wheelchair users, there was no need for high ceilings nor doors, which made the ones who could walk constantly hit their heads.

This is called social model of disability. It suggests that the disability is not the problem, but the society surrounding the individual. What one considers disability is just one's struggle to fit in the current society one way or another. (Ulster University.)

In our current society, many abilities or traits, or their lack thereof, can produce situations where one can find themselves unable to individually act. These include, but are not limited to, mobility impairments, visual impairments, hearing impairments, and age-related issues. (SFS 2010, 21-52.)

2.2.1 MOTORIC PROBLEMS

A large portion of the populus who suffer from motoric problems use movement tools in their everyday lives. As a careful approximation, in 2010 10% of Finns had permanent mobility impairments and 5% a temporary ailment. The tool users have different reach areas compared to others and require appropriate placement of countertop heights to be able to act by themselves. (SFS 2010, 22, 89.)

In comparison, a person who does not need any movement tools, requires 600 mm of width space, whereas person with a walking cane needs 750 mm, walking stand 850 mm, wheelchair 700-850 mm, crutch 900 mm and axillary crutch 950 mm. Additionally wheelchairs require 1500 mm rotation space in public, and 1300-1500 mm in apartments. Electric wheelchair needs 2500 mm. Leg space, door opening, or recess can be used. For people who use these assistive devices, it is also important that automatic doors open, as they have plenty of trouble if they do not. (SFS 2010, 22.) When building for people with motoric problems, sliding or rolling doors are preferred (Väyrynen et al. 2004, 121).

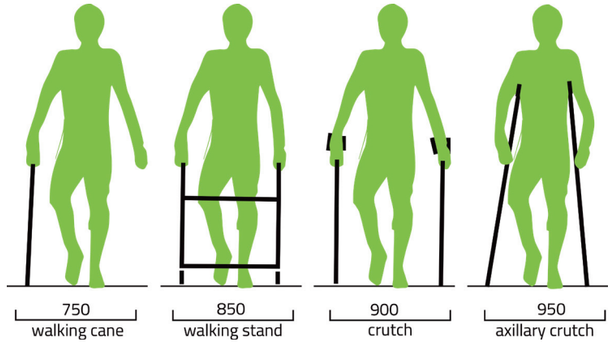


FIGURE 3. THE WIDTHS DIFFERENT MOVEMENT TOOLS NEED. (ORIGINAL SFS 2010, 23.)

For a wheelchair user, the worktop should have 67 cm of free legroom, with a width of 80 cm and depth of 60 cm. Their reach to front and side is 50 cm, 40 cm downwards and upwards to the height of 110-140 cm. (Väyrynen et al. 2004, 121.)

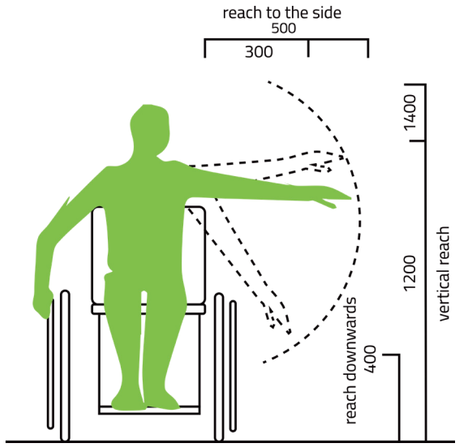


FIGURE 4. REACH OF THE WHEELCHAIR USER. (ORIGINAL SFS 2010, 23.)

A person with motoric problems, but who is still able to walk, is usually able to ascend stair steps that are 12-13 cm high, whilst to wheelchair user a 2 cm difference in height or a gap with the width of 4,5 cm proves to be difficult. Most stress-inducing parts of everyday life for people with motoric problems are weather, traffic jams and rush. (SFS 2010, 23-24.)

2.2.2 VISUAL IMPAIRMENTS & HEARING PROBLEMS

Compared to people with motoric challenges, people with visual impairments have significantly different needs. Elevators, which are one of the most important tools for the first group, can be the most difficult ones to use for the latter. How do you find summon and floor buttons when you do not see. If the elevator lacks any kind of notification system, how does one know on what floor they have ended up on. (SFS 2010, 27-30.)

There are many ways to help design better environments for the visually impaired. Voice guidance

systems and tactile paving guides, specifically those implemented on floors, are among the most important. Angles, slopes, level differences, material differences and strong contrast differences can also help guide visually impaired. (SFS 2010, 27-30.)

One way to make welcoming environments for people with less severe visual impairments is to use illumination on wall surfaces. Large glass surfaces and mirrors can be a hazard. For visually impaired, the most important aspect is the continuity of guidance. (SFS 2010, 27-30.)

Populus with hearing problems need clear visual guidance. Voice-based alarm systems are difficult, light or touch based systems are way more usable. All the spoken language should have a written or pictorial alternative. (SFS 2010, 33-42.)

2.2.3 ELDERLY

The performance of an individual will decrease due to growing older. There are significant differences between individuals, and the difference grows larger as people get older. SFS- handbook mentions that the two main models that follow the performance of the elderly are WHO's ICF classification and the Disablement Process Model. (SFS 2010, 45-51.)

There are many ways to prevent functional impairments. Muscle strength and balance are main factors. An environment that maintains and promotes performance would be optimal for the elderly. (SFS 2010, 45-51.)

2.3 WORKPLACE ACCESSIBILITY

Current progress in technology allows for better opportunities for people with disabilities or chronic diseases to work. Finland has done less adaptive solutions to enable these groups to work when compared to other EU countries. (SFS 2010, 63-77.) Commute causes strain, and people with visual impairments and motoric problems feel it the most. Bad weather and traffic jams make it even worse. (SFS 2010, 63-77.)

Office chair is an important tool for people with motoric problems. Wheelchair can be used as a working chair, but usually lacks adjustment options sufficient for the job. Aside from the chair, shelves are also important to note when inspecting the workstation. Shelves and other surfaces should be placed so that the user can easily reach them. For wheelchair users, it is best to have sliding or roller doors, as hinged doors can be problematic. (SFS 2010, 63-77.)

2.4 ACCESSIBLE DESIGN

The principle of accessibility asserts that objects and environments should be designed to be usable by as many as possible. Accessible design was seen as an accommodation for people with disabilities, but as time has gone on, it has been understood that the alterations that result from accessible design benefit everyone. Accessible design has four distinct characteristics: perceptibility, operability, simplicity, and forgiveness. (Lidwell et al. 2010, 16.)

Perceptibility is the existence of design that can be perceived by anyone, no matter their sensory abilities. The perceptibility of a design can be enhanced by font decision, tagging for sensory technologies, and positioning the controls and the information so that the users can easily perceive them. (Lidwell et al. 2010, 16.)

Operability is freedom for anyone to control or use a design regardless of physical abilities. Improved operability is achieved by minimizing repetitive actions and the need for continuous straining physical input. The positioning of controls and information about them is also important. (Lidwell et al. 2010, 16.)

When everybody understands a design easily, whether they are literate, focused, or inexperienced, the design can be considered simple. To attain simplicity, a design should be stripped of unnecessary complexity, and give clear feedback to the user. Clear coding and labelling are important. (Lidwell et al. 2010, 16.)

Forgiveness is the minimization of occurrences and consequences of errors. The means to achieve this are good affordances, reversibility of actions, safety nets, confirmation, warnings and help. (Lidwell et al. 2010, 16.)

Affordance refers to the relationship between user and the physical product or object. For example, a chair affords sitting. The chair can also have other affordances at the same time, but depending on the person the affordances might be different. The chair can have the potential to be lifted, but depending on whether the user is strong or not, the affordance might or might not exist. The existence of affordance is wholly dependent on the relationship of the user and the object. (Norman 2013, 12.)

If an affordance cannot be perceived, it needs a signifier. Affordances can exist without signifiers, but without them users might not be able to understand the potential features of a product. The signifier is a signaling component. While affordances determine what actions are possible, signifiers show where the action should take place. (Norman 2013, 12-14.)

Signifiers are not limited to be only visually perceivable; they can also be sound-based. A good example of this is the click of a toaster when toast is ready or the whistle of a teakettle when water is boiling. Sound-based signifiers are also a great way to tell if product is working fine, or if it is in need of repairs. (Norman 2013, 155-156.)

2.4.1 HUMAN-CENTERED DESIGN

Human-centered design is a design philosophy. It puts human needs, capabilities, and behavior first. Psychology and technology are the starting point for good design. Good design requires good communication and when things go wrong, its importance is increased. (Norman 2013, 11.)

David Townson, a design consultant, talks about the seven tenets of human-centered design. According to him, it is most important to consider everyone design has an impact on, instead of a one defined primary user. The ones who have their lives impacted by, are factory-workers, couriers, technicians, and mechanics who work with the design at least to some capacity. (Design Council)

The seven tenets he lists are:

- GET PAST YOUR OWN GREAT IDEA.
- DO NOT BE RESTRICTED BY YOUR OWN KNOWLEDGE.
- SPEND TIME WITH REAL PEOPLE IN REAL ENVIRONMENTS.
- IDENTIFY OTHER USERS.
- FOLLOW YOUR USERS LEAD AND NEEDS.
- THINK ABOUT THE WHOLE JOURNEY OF THE PRODUCT.
- PROTOTYPE AND TEST YOUR IDEA.

(Design Council.)

To make sure the process has been human-centered, one should ask themselves, if the value for people is the goal, or are there compromises that result in mediocre end-results. The CEO of PepsiCo, Mauro Porcini (2023) lists many similar questions that help assess if the innovation process is

human-centered.

He also states that there exists five superpowers when designing for humans. These are the power of alignment, internal co-creation, external co-creation, the shiny object, and confidence. (Porcini 2023, 35-36.)

The Power of Alignment refers to the mutual understanding of an object between members of a design team. While a word can describe a theme or an object, it is not as valid in creating mutual understanding as a visual media like sketch would be. As an example, Porcini gives a knife: while everyone will know the word, they will mostly end up thinking about different knifes, whereas with a sketch, the specifications of the meant knife would become obvious. (Porcini 2023, 35-36.)

Both of the Powers of Co-creation are about the importance of pouring the experiences of different people into the design. Everybody can bring something new to the table. Internal refers to inhouse development teams, while External is about dialogue with clients and customers. (Porcini 2023, 36.)

The Power of Shiny Object states that having a tangible, thus seemingly realizable design, creates excitement and interest from both target audience as well as sponsors and investors. The Power of Confidence highlights the importance of iterative design, and the positive evolution and confidence it creates for and towards the concept. (Porcini 2023, 36-37.)

While the lists presented by Townson and Porcini are vastly different, they both emphasize that one should not be restricted by their own ideas and understanding but cooperate with different people. Both also emphasize the importance of prototyping and collecting relevant information. To me, it seems that Townson's list is truly about creating a product for humans while Porcini's list prioritizes the excitement of the product more.

According to Thomas Ask, when designing for humans, human factors must be factored onto the design. Human factors are ergonomics, handle designs, anthropometry, kinesiology, mapping, human injuries related to design, biomimicry, interaction design, expert systems, and artificial neural networks. (Ask 2016, 139-150.)

Ergonomy as a science focuses on the understanding of interaction between humans and user interfaces. On the other hand, as an area of expertise it utilizes theory and knowledge to design practical methods to optimize overall performance. (Väyrynen et al. 2004, 15.)

Ergonomy needs research: designer cannot find the most optimal product with only reasoning and checklists: the importance of research and experiences should be emphasized. The main two doctrines of ergonomy are that the product must be designed to support humans and the design process must take the user needs into account. The individual differences between humans makes this challenging, but the products should be done with a conviction that the quality of a product and the aspects leading to it affects the users live and welfare. (Väyrynen et al. 2004, 9.)

In practice, the two doctrines lead to a few different results in usability. An ergonomic product should consider the physical and mental strain the product causes and aim to lessen it. This also enhances the individual performance and makes the use more reliable. The user groups measurements, strengths, and ability to move should be taken into account. User interfaces like control systems should be designed to be easy to use; the interface should also be in an easily accessible location so that using it minimizes the strain on the user. (Väyrynen et al. 2004, 15-16.)

2.4.2 UNIVERSAL DESIGN

According to Jane Bringolf, "universal" and "accessible" design are often misinterpreted due to failing to understand what exactly universal design is. This has allowed terms such as "Design for All" and "Inclusive Design" to pop up, that are all synonymous with each other. The main concept in all of them is the same: designs for the whole of the population bell curve with the aim to enable as many people as possible to be able to use them regardless of their background. (Bringolf 2008.)

Universal design automatically includes many with disabilities, but this does not mean that it would be the same as accessible design. Universal design aims to be accessible by the most amount of people, while accessible design takes into account the people with disabilities and the designs are created to enable them. (Bringolf 2008.)

As stated by Vladislav Gavriluk (2023), whereas accessible design is most interested in the welfare of a strictly defined group's interests, inclusive(universal) design covers the humanity as a whole.

Universal Design has seven principles, developed by North Carolina State University. These are equitable use, flexibility in use, simple and intuitive use, perceptible information, tolerance to error, low physical effort, and size/space for approach and use. (Bringolf 2008.)

2.4.3 MEANINGFUL DESIGN

Mauro Porcini (2022, 37-40) uses the term meaningful design. He has listed twelve different principles that clarify what meaningful design should be. These twelve are divided into three groups: the fundamental, the enabling and the clarifying principles.

Porcini states that fundamental principles are the foundation of every project and the ones that connect all the other principles. Two principles are listed as fundamental. The seven enabling principles enable the solution to be aligned with the foremen-tioned fundamental principles. The final group, the clarifying principles, aim to clear undervalued and misunderstood aspects of the design project, that correctly applied exponentially increase the value of the solution. (Porcini 2022, 38.)

The two fundamental principles are the human and innovative principles. Human principle consists of three aspects that all our projects should accomplish to fulfil: resolve a specific functional need, generate an emotional connection, and have a semiotic value. Semiotic value refers to the product's ability to tell a story. For example, the story that the product tells, can be that the owner is rich, creative, or even something even more specific. The user can be either aware or unaware of the implications the product has attached to them. (Porcini 2022, 38.)

The second fundamental principle is the innovative nature of the solution. This consist of the needs for meaningful design to be new, unique, distinct, and extraordinary. (Porcini 2022, 38-39.)

Enabling principles consist of various prospects from the viewpoint of sustainability. The design should be sustainable in aesthetics, functionality, emotionality, intellectuality, socially, environmentally, and economically. (Porcini 2022, 40-41.)

The last three principles are the Clarifying Principles. The tenth principle establishes the point that there is no such design as objectively good design: design's worth is always dependent on the person and their needs and desires. The eleventh principle is that even given the same process, different designers will end up with different end-results. Porcini calls this the Principle of Poetic and Expressive. The twelfth principle is the Principle of Storytellability. (Porcini 2022, 41.)

2.5 CONSENSUS

While the competition's theme is "Accessibility", it seems it seeks more of a universal design concept than accessible. The seven tenets Townson (Design Council) *lists would appear to be a good checklist not only for a project aiming to create accessibility, but for any project. The repeating factors between all of the different definitions are resolving a functional need and ease of use.*

Another unifying factor between the different design ideologies, is the desire to create value for the design concept through different aspects. The aspect could be simplicity, ease-of-use, sustainability, emotionality, or one of the many others listed. The importance of each attribute can be found through identifying the needs and wants of the end-user.

3. DESIGN PROCESS

The product development process usually consists of several already well-known segments. All of the segments may not be present in every project. In chronological order the segments are the identification of the need, finding the problem, synthesis, analytics, optimization, testing, start of the production and review. (Hietikko 2021, 46.) Understanding context surrounding a design project plays a critical role in research considerations and finding the research solutions (Leonard & Ambrose 2019, 37-38).

According to Thomas Ask (2016, 5), design thinking process consists of five different states: empathy, problem definition, ideation, prototyping and testing. On the other hand, Aspelund Karl (2022) proposes that design process consists of following: inspiration, identification, conceptualization, exploration/refinement, definition/modeling (form, material, color, detailing and decoration, function), communication and production.

These three ensembles of segments might seem very different from each other, but they all fit in the widely accepted Double Diamond model. While the names of the implied sections of a design project differ, they are all just differently sectioned parts of the design process whole.

The Double Diamond is a visual description of design process. It was launched back in the year 2004. While working as an indicator of the design process, it also doubles as a checklist for the key principles and design methods required in design. (Design Council.)

The two diamonds represent the divergent thinking and convergent thinking present in design process. The diamonds are separated into four different parts: discover, define, develop, and deliver. While appearing as chronological entity, one of the main points is that the process is not linear. Taking a step back with newly acquired information enables testing ideas and finding new discoveries. Nowadays, thanks to the world's ever-changing nature, and the constant feedback, no idea is truly finished and an iterative model like Double Diamond is instrumental. (Design Council.)

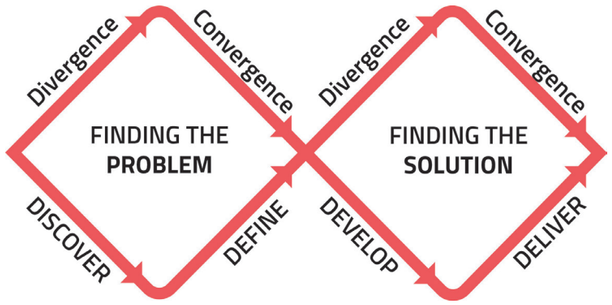


FIGURE 5. DOUBLE DIAMOND -MODEL.

Discovery phase is the phase of understanding, it is the process of finding new information and trying to understand the problem field. It is imperative to speak to the people who are affected by the design. The counterpart, define phase, is the time when designer reflects on the information gathered in the discovery phase, and defines the problem field. (Design Council.)

The second diamond starts with the development phase. It encourages the designer to find different answers to the question previously found. The diamond's last part, deliver, involves testing the solutions focusing on the ones that will work and rejecting the ones that do not. (Design Council.)

The two diamonds represent the two phases of design process: finding the right problem and fulfilling a human need. Inside the double diamond exists a human-centered design process, that is composed of four different activities: observation, ideation, prototyping and testing. This is often called the spiral method as when the four activities are iterated, each iteration is closer to the answer that is being sought. (Norman 2013, 221-222.)

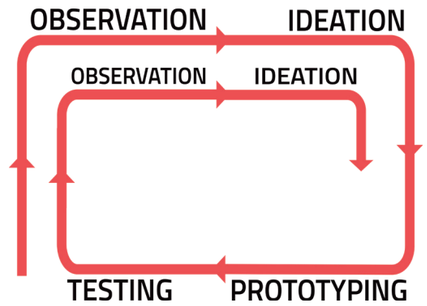


FIGURE 6. THE ITERATIVE CYCLE OF HUMAN-CENTERED DESIGN.

Observation refers to the design research: research done to understand the customers interests, motives, and true needs. Ideation, or idea generation, is the part of the design process where creativity is critical. It is a part where different types of ideation techniques are used to attain two goals: to create as many designs as possible and to be creative without any constraint. (Norman 2013, 222-227.)

In the prototyping phase the goal is to find out if an idea is reasonable. For this reason, a prototype or a mock-up should be constructed. The mock-ups can be simple sketches, cardboard models or anything that effectively conveys the idea. The better the idea is conveyed the better results one can obtain through testing phase. (Norman 2013, 227-229.)

There exists quite a plenty of different problems in innovative work. One will have to go through many compromises, deal with the details, economy, time, and dynamics. Dynamics refer to the ever evolving, turbulent nature of technology, changes in customer preferences, and competitors' products. One should be always aware, that the product that they design, is not just the physical output of the process, but the whole entity around it. (Hietikko 2021, 19-20.)

To make sure the designed product will create a positive product experience, the design should not be "just a tool", but feel personal, be operatable by the user and create a feeling of reliability and control. (Väyrynen et al. 2004, 223)

3.1 IDEATION TECHNIQUES

Ideas do not have much value by themselves, but they might be useful. They are created in vast amounts and through mixing, recombining, evolving and using other methods will they take their shape. Some spontaneous ideas can exist in projects, but most of the ideas are deliberately generated through ideation techniques. The ideation techniques aim for quantity over quality. Letting go of ideas is important. (Stickdom, Hormess, Lawrence & Schneider 2018, 156-157.)

The ability to choose between ideas is important. The main guide frame to choosing is to quickly find ideas that are "good enough". Later iterations will confirm if they are usable ideas or not. At the start of the project there is very little risk involved. (Stickdom et al. 2018, 159.)

Brainstorming is a group ideation method. The emphasis on brainstorming is the quantity of ideas instead of quality. Criticism of ideas is forbidden. After a brainstorming session, the concepts potentials should be identified for their merits for follow-up ideation. Brainstorming is one of the most familiar concepts within the industry. (Childs 2013,

56.-57.)

Brainstorming has several principal rules associated with it. It should be undertaken as a team, no more than 10 people, no criticism or mockery of ideas, design brief should be clearly stated, a set period of time allocated, and an individual should be identified to introduce the brief. (Childs 2013, 58.)

10 plus 10 is an alternative approach to brainstorming. A team is given a few minutes to draw ten rough concept sketches, after which they explain them briefly. An interesting sketch is chosen among the initial ten, and ten more variations are made of the chosen one. (Stickdom et al. 2018, 179.)

Storyboarding has traditionally been used in advertising, filmmaking, animations, and video games. It is increasingly popular in design. Storyboard is a time-based visualization of how the product is or might be used. It can be created either through sketching or taking photos. It is an easy way to communicate the value of the product and perhaps problems a design might have. (Henry 2012, 184-185.)

SCAMPER stands as an acronym for Substitute, Combine, Adapt, Modify/Magnify/Minimize, put to other uses, Eliminate, and Reverse/Rearrange. The method was developed by Osborn and named by Bob Eberle. (Childs 2013, 74.-75.)

Mind map is a visual representation tool made popular by psychologist Tony Buzan in his 1974 book Use Your Head. It can be a very beneficial tool especially in the early stages of a design project. Using mind maps is a great way to avoid overly linear thinking. (Milton & Rodgers 2013, 56.)

3.2 SKETCHING

Sketching is an important part of the iterative design process for a few different reasons. Sketching is quick, timely, disposable, plentiful and minimalist. Sketches do not need long time investments, they can be produced when the need arises, are useful in exploring concept with little production costs, they are able to explore different aspects and interactions, and they are able to clarify one concept at a time. (Rojas 2023.)

They also have an important role in communicating your ideas in their entirety to the designer and the possible team. There are several elements that help to make more readable sketches:

- ANNOTATIONS

Text labels that annotate different elements of the sketch to clarify that tie everything together.

- ARROWS

An easy way to illustrate interaction flows, sequences of events, movements, or direction.

- NOTES

Text that provides additional insight for the sketch. The note can include detailed explanations, list unresolved issues, explore elements not present in the sketch, clarify the purpose and each element. It is also a way to keep record of ones thought process. (Rojas 2023)

3.3 AESTHETICS

Aesthetics is the term used for appreciation of how things look and how people understand them. It can be argued that it is an innate trait for objects, even though many judge that it is a value that the viewer gives it. Aesthetics are important, as they are the first thing the viewer will see, but the aesthetics should be backed by understanding. (Leonard & Ambrose 2019, 52.)

Trends are short lived occurrences that have a huge effect on current fashion and aesthetical understanding. It is important to be aware of them. They appear on design, fashion, technology, and art. (Leonard & Ambrose 2019, 52.)

Our brains look for meaning and connections between things: they do not understand everything, instead they interpret what we see as entities. This is called perception. Gestalt theory is one of the most known theories on human visual perception. It has resulted in over 140 principles that work simultaneously. Understanding and using these principles helps to communicate ideas better. (Eissen & Steur 2014, 30-31.)

While Gestalt psychology mainly explains phenomena in 2D environments, one must remember that 2D sketches are usually representations of 3D environments and objects (Henry 2012, 27).

"Gestalt" is the German word for shape, figure, or form, and is an interchangeable word for design in Germany. The Gestalt psychology springs from the writings of Austrian philosopher Christian von Ehrenfels. According to him, in music, we hear the whole melody, not individual notes. The main philosophy behind Gestaltian thinking, is contained in the phrase "the whole is greater than the sum of its parts". (Henry 2012, 27.)

Some of the recognizable core Gestalt principles are concise, closure, similarity and proximity. The Principle of Concise, also called the principle of Prägnanz, is the fact that humans try to find the simplest form and try to organize visual information into something more easily understandable. The Principle of Closure is the human brain's ability to complete incomplete images and find balance and symmetry. Symmetry overrides the grouping effect. (Eissen & Steur 2014, 30-45.)

The Principle of Similarity describes the grouping of elements that look similar. Color, value, texture, size, position, or anything that may make something similar or dissimilar causes this. For example, grouping can be used to communicate to the viewer what sketches are part of the same collection. Principle of Proximity is comparable as its main essence is the grouping brains do to visual elements that are close together. (Eissen & Steur 2014, 40-45.)

Golden Ratio is a ratio within an element, approximating 0.618. It is found throughout nature, art, and architecture. Golden Ratio should be considered when it does not come at an expense of another design objective. It is similar to the rule of thirds that is also known as golden grid rule: in short, rule of thirds is a rough approximation of the Golden Ratio, but it has superior simplicity. (Lidwell et al. 2010, 114-115, 206-207.)

3.4 RESEARCH AND INTERVIEWS

Design research is concerned with what ought to be, instead of what is, like scientific research. Design research challenges, provokes, and disrupts the status quo. Design research uses representative images, physical models and 3D prototypes while developing things that do not yet exist. Design research can be split into three categories: research into and about design, research as design and research through design. Research can be divided into two forms: primary and secondary. (Milton & Rodgers 2013, 11-12.)

The research should be recorded and documented in some way. The optimal tool is accessible, easy to manage and suitable for the task. In the planning stages of the project the best method for the current project should be considered. It is easier to choose if the decision about what should be recorded, how and why has been done. A sketchbook is a fine medium to keep adding insights, research, and resources. Recording interviews as either videos or just voice files is also an option. (Leonard, Ambrose 2019, 82.)

Successful design requires deep understanding of the userbases actions, styles and wants. Collecting user data and using it as a design principle is a huge competitive factor. There is plethora of different ways to collect information. (Hyysalo 2009, 7.) *The thesis will mainly focus on interviews.*

An aspect that concerns all the different types of interviews is the question of successful question layout. The host of the interview should be careful not to lead the interviewee. Questions that focus on ones experiences are more viable than ones that try to find the answer through interviewees reasoning or assumptions. An overly critical point of view should also be evaded. Open questions often lead to more accurate end-results, and should be used, as more defined questions can skew the interviewees potential answers. (Hyysalo 2009, 129-130.)

Before the interview, the interviewer should have researched the subject and have a at least basic understanding of it and have clear aims and objectives. A list of talking points will help the communication. Interviewer should appear calm, objective, professional and approachable, while making sure the interviewee is comfortable. (Leonard, Ambrose 2019, 102.)

The interview can have positive effect if items/pictures or such are used to communicate the ideas better to the interviewed. According to Hyysalo (2009, 134-135.) one can achieve better results from interviews with simple tricks: interested question asking, agreeing with the interviewee while asking for their reasoning, and body language.

Interviews are a great way to find in depth information about a particular problem. Compared to questionnaires, the main benefits of interviews are the relatively small group needed and the ability to deviate from the planned questionnaires to inquiry about interesting and unexpected lines. It is possible to gain far deeper understanding. While interviews can be done as physical meetings, webchats and telephone conversations are a solid option. (Leonard, Ambrose 2019, 102.)

Open interviews do not require a premade structure and allow the interviewee more freedom to tell about the subject matter. The interview can be loosely based on a light structure, that the interview follows depending on the situation. It allows for a varied and liquid gathering of information. Requires the interviewer to focus attention to necessary viewpoints. (Anttila 2006, 196.)

Interviews usually include similar parts, no matter how structured they are. These parts are introduction, warm-up questions, general questioning, specific questions, return to the general questions, and finishing. (Hyysalo 2009, 137-138.)

A typical interview consists at least of the following questions:

- WHEN AND WHY DO YOU USE THE PRODUCT?
- DESCRIBE THE SITUATION WHEN USED?
- WHAT DO YOU THINK ABOUT THE CURRENT PRODUCTS?
- WHAT DO YOU NOT LIKE?
- WHAT DO YOU LOOK FOR WHEN MAKING A PURCHASE?
- WHAT WOULD YOU DO DIFFERENTLY?

(Hietikko 2021, 66.)

One can also gather information by being the user or by observing the user. All information gathering methods have their good and bad points. (Hyysalo 2009, 111-112.)

The collected materials can be used to map customer needs. All the needed user characteristics are searched with a five-step process:

- COLLECT INFORMATION ABOUT THE CUSTOMER/END-USER.
- INTERPRET THE FINDINGS AS CUSTOMER NEEDS.
- ARRANGE THE NEEDS INTO A HIERARCHICAL STRUCTURE.
- SPECIFY RELATIVE IMPORTANCE TO THE NEEDS.
- REVIEW THE RESULTS AND PROCESS.

(Väyrynen et al. 2004, 219.)

Recognizing the needs is essential in product design and development. The goals for finding the needs are to make sure the product matches a need, recognize the hidden needs, find the facts, and save the procurement procedure, to make sure a critical need is not bypassed or forgotten and to share an understanding of the needs between development team members. (Väyrynen et al. 2004, 219.)

Surveys are not efficient enough for finding the customer needs, even though they do serve a function later on the development process. Surveys are insufficient in gathering information about operating environment information and hidden needs. (Väyrynen et al. 2004, 220.)

4. PROJECT

The problem field the competition gave was large and mostly undefined: Cool Accessibility. What would even fit that description? How should one approach the problem?

I decided at the early stage of the development to make a design that would benefit the people who need accessibility the most: people with disabilities. I asked my friends for contacts and was able to find three potential interviewees. They ended up as the most crucial part of my design process.

The goal was to create a design that would benefit the target audience, but also create beneficial product for everyone. I mainly disregarded the cool as a filler word. What would something need to be cool? And would not a product that is accessible or that would elevate accessibility be cool in on itself?

Another aspect that affected the choosing and design process was the project's ties to the Kone through the competition. During the project there were many times where I had to consider whether my design would fit Kone's product catalogue at least somewhat. It ended up not being a focal point in the design process.

4.1 INTERVIEWS

For interviews, I wanted to find at least a few persons, who had experienced using wheelchairs in their everyday lives. As I did not personally know anyone who fit the description, I started asking some of my contacts who might have connections to one.

I was aware that a Master of Education I know, works as special education teacher and might be able to lead me to interviews with persons using wheelchairs. For my dismay, while discussing the matter with her, it became apparent that I would not be able to interview her students. I decided the best course of action would be to interview the Master of Education herself, as she would surely have become aware of limitations people with disabilities go through in their everyday life through her work.

Through this interview, I got some much-needed perspective on the matter. We went through plenty of problem areas that could hinder one's everyday life. The discussion was a bit derailed by problems that most individuals would face instead of the ones the target audience would have. Through the interview I was able to cement a few problem points I would use as the base for my upcoming question patterns.

We ended the interview by concluding that shops are one of the main culprits of inaccessible design. Shops have a myriad of problems when it comes to the accessibility: the shelf height and designs, doors and freezers are all potential everyday frustration inducers.

After the interview with the Master of Education, I was able to schedule interviews with three potential interviewees, this time with wheelchair experience. By chance, their mobility levels without wheelchairs were different: one could somewhat walk without, whereas the other two would have had great difficulties. Through their eyes and stories, I was able to find problems I never even knew existed.

The initial main question in the interview was what breaks the flow in everyday life. Another major question focused on the special features that Kone and Huld have on their products and if the inclusion of these attributes would benefit everyday products. These separated features were voice-operability, smart displays, and sensors.

Other than the two beforementioned questions, I kept the interviews somewhat open ended. On the first round of the interviews, I was not confident I knew enough of the subject matter to set following questions beforehand. The open-ended questioning did end up giving me great results.

4.1.1 WHAT BREAKS THE FLOW IN EVERYDAY LIFE?

The first question was a success. It was easily approachable by everyone. There was plethora of problem cases the interviewees found from their lives. Many of these flow breakers were, and are, present every single day.

First larger problem area that came up was doors. Regular doors are already problematic for wheelchair users, thus sliding doors, but the problem is much more prevalent than that. Many of the common public door types cause uncomfortable situations.

Automatic doors are great, but they do not always work due to the wheelchair users lowered height. Otherwise, they are a lifesaver and a necessity. Circle doors are not even comparable, and it is no surprise that it is statutory to have a normal door next to them. Majority of the interviewed did not even find a reason for the existence of such doors.

Doorsteps are also a major problem especially in older buildings. It became clear that one of the biggest problem fields in accessibility is architecture. Even newer buildings have narrow corridors and tight spaces that restrict movement. As one of the interviewed said: "usability is worthless if one cannot even enter the building."

Other everyday things mentioned that break the flow were the heights of user interfaces, counters, payment terminals, mirrors, ATMs, bulletin boards and shelves. The height of the person using a wheelchair causes many problems, as everything is built for a standing person. One of the interviewees talked about the time they were in Osaka as there the elevators had lowered control panels outside.

Elevators are one of the most important inventions for wheelchair users, so there were quite a few problems with their designs including the aforementioned control panel height. One of the most pressing problems was the location of public elevators. Many of them are either behind locked doors or are just located way of the main passages.

Whereas elevators were one of the most important inventions, what about escalators. They do serve the same purpose after all. When inquiring about this, I was told that if there was something wheelchair users fear, it is escalators. Theoretically they can be used if one has a small wheelchair, but they are incredible dangerous, as one mistake can send the user tumbling down the entire length of the contraption. The only other appliance that was spoken of with such loathing, were some unreliable industrial elevators that the interviewees had had to use in their lives.

Other noteworthy mentions are buffets and cluttered cafés which cannot be accessed by wheelchair users. Stone paved roads were also a significant problem, especially when pedestrian crossings were paved.

4.1.2 FEATURE INCLUSION

The second question was not as great of a success as the first one. The interviewees had difficulties finding useful applications for the features listed. The listed features were voice-operability, smart displays, and sensors. There could have been potential answers behind this question, but in this case, it was not to be.

I did try to guide them through the question, but this did not result in any breakthroughs. The most this question resulted, was the notion that voice controls would be a nice addition to most appliances, but public places would not benefit from them. Smart displays would also be a welcome addition, assuming that the user interface is intuitive.

4.1.3 OPEN-ENDED

After the first two questions, I somewhat started to understand the problem field and was able to guide the discussion on to other questions that would benefit the design process. This more open interview style led to many breakthroughs in comprehension of the problem field and helped to remove most of the incorrect assumptions I might have had before.

Many of the areas I would have previously thought to be problematic for wheelchair users ended up not to be, thanks to already existing solutions. The prevalence of the shops as a problem field quickly faded, as I learned the interviewees would only seldomly if ever go to shops by themselves. They would always have a companion accompanying them, so the problems found in there were not as prominent as initially thought. If no companions are present, clerks are there to help.

Libraries are comparable establishments to shops. But in many aspects, they work better. They are often logically structured, have open spaces, are easily accessible and best of all, they are accessible through internet.

One of the potentially problematic aspects that came up was seasons. Beforehand, I had thought that winter would be the most troublesome season for wheelchair-users, but all the interviewees agreed that spring and autumn are the most frustrating due to slush. Winter was seen more as a logistical problem: if the logistics are well-structured, winter poses no real problems.

Another potential problem field that was considered was public transportation. They indeed are a problem, but the majority of it can be circumvented by using invalid taxis that exist solely for this purpose.

Interviews continued through the whole design process. The latter half of the interviews had a more focused operating model. As the interviewees stayed the same and knew what the project was about, it was easy to update them on the new and updated ideas and concepts I had and collect their opinions and suggestions for improvement. Their feedback is incorporated into the following design process chapters.

4.2 BENCHMARKING

At the start of design projects, I tend to not benchmark too much as most of everything has already been invented. This will often lead me to invent a wheel anew, but I see it as an important step in building knowledge and understanding of the field I am working with, especially if it is previously unknown to me. If I were to know what has been already created, my ability to see the themes behind the inventions could get cloudy, and I would have difficulties to find other options than those that already exist.

On the later stages it is imperative to benchmark similar concepts, as they are an easy way to find out if one's current idea would work or not. Combining existing products and ideas is not a bad way to advance a design concept, so benchmarking as soon as possible can be a viable solution if the situation calls for it. The side effect of this is that the upcoming ideas will be more grounded, which has both a positive but also a negative impact on one's design process.

During the earliest benchmarking, which was done after the initial brainstorming, many interesting concepts were found. At this part of the project, most impactful were the magnetic levitation technology (Elevator Business 2019) and the implementation of AI to industrial application. Learning about the pros and cons of AI implementation was important; while it created a whole new world for possible innovations, it was also stated that the implementation was costly and would likely create problems with privacy (Kingson 2023).

Another major influence were industrial storage carousels. Later on during the project, I found similar applications designed for specific private uses, which confirmed the functionality of one of my main designs. Other noteworthy benchmarks included an elevator operatable by one's feet only, kneeling busses, and an elevator that could move in all directions.

4.3 WHAT IS ACCESSIBILITY & COOL

It is important to ask what accessibility is. I distinguished that it can be as a simple matter as reachability and mobility. Senses enable more accessibility: whether you do not see or hear well, your ability to access is hindered. Missing a limb or several has a same impact. Getting older also severely hindrances one's abilities.

The question of what is cool is not that important, as answer to that is highly individual. Some aspects I listed as potentially cool are playability, music, novelty, humanlike features, inclusivity, reachability, sustainability, viability, and desirability. These "cool" aspects mainly fit two categories: novelty and accessibility.

Novelty aspects include everything from playability to just being novel in some way. These aspects can be seen as product selling, even though they rarely are the main function products have. Exceptions do exist. On the other hand, accessibility aspects include many issues that have been already addressed here: reachability and inclusivity included. Accessibility in on itself is cool, so there is really no reason to worry whether the product will have added cool factors.

4.4 AI

Even though I shied away from using AI programs during the process, I gave it a try. As I was most familiar with the AI program Inferkit I gave it a go. Inferkit is a text generator that continues what you have written and is targeted to novelists and app developers. It often produces interesting continuations to what has been written, so I saw some potential in it.

I decided to try what the program would come up with from the following prompt:

"A brand-new invention! A cool advancement in the field of accessibility! It is the"

The program did not ware in this task as well as I had hoped. The most relevant ideas it came up with, were "eye swipe -gestures", which are already a thing, and "disability goggles". The latter's intended use was nonsense though.

The most thought provoking answer I got, was that 'the most revolutionary invention for accessibility is the mobile phones'. I would not disagree with this notion, but it did not benefit the production. I

quickly abandoned the AI usage and went back to the more traditional ways of designing.

4.5 STARTING WITH THE DESIGN

A successful design process is a combination of many different aspects. Personally, I value constant feedback during the design process over anything else. To make sure that I would be able to design the best I could, finding the right environment for working feedback loop was imperative from the get-go.

From the very start of the project, I was able to create an environment most beneficial for my ambitions. The first feedback group were the wheelchair users, who were the core and soul of the design process. But to make sure my design would succeed, more professional design feedback was also a necessity.

As luck would have it, I heard that a course where one could focus on the competition I was attending would start not soon after I had started working on it. The course worked as an extremely important feedback loop for me during the design process. Not only was I able to get feedback from other design students, but also from mentors from the University of the Applied Sciences.

During my studies in design, I have also found out that the most important feedback group one can find, are trustworthy friends who are capable of bringing forward their opinions on the design. Whether that be on the basic idea, materials, technical limitations, or appearance, it is something that can elevate even the most basic of concepts.

4.6 BRAINSTORMING

Before the start of brainstorming, I find it helpful to have analysed the terms and elements that are important for the production. The terms I found important to have a proper look into were “accessibility” and “cool” which the first one was the more important of. I distinguished plenty of different aspects that one could find accessible or cool. Later on, other terms affiliated with accessibility became important as well.

Coming up with large quantity of designs is essential for the purpose of finding solutions. Whether the ideas are good or bad, they can often be used later down the road. Even bad joke ideas can often end up as some of the leading ideas with proper polishing. The initial ideas were done between of the early interviews, so even the very first ones have had been influenced by the interviews at least to some degree. It is important to be open minded and encourage diversity when brainstorming.

As I already had a good grasp of the problem field I had decided to aim my design concept for, coming up with ideas was effortless. The initial brainstorming was done at school with other design students who had their own ideas regarding the competition. There will be no materials from other students, except for one basic concept on this thesis.

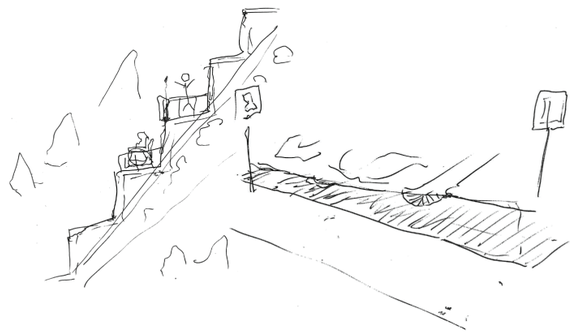


FIGURE 7. SIGHTSEEING ESCALATOR AND AUTOMATED WALKWAY.

There were three different types of ideas on the first session: absurd, somewhat plausible, and those that had had some time to form on my mind thanks to the early interviews. In the absurd category there were the concepts for sightseeing escalators and automated walkways. Both of these ideas escalated what could be possible to impossible levels, resulting in ideas, that while futuristic and cool, would most likely end up unusable.

The plausible ideas were automated parcel locker, a map app, doorstep -solution, door remote, large-stepped escalator, and circle door with control lights. These were all ideas based on different situations in life, that may challenge one’s standards of accessibility. Out of these ideas, the most promising one was the map app, designed to be used in shops to allow one to find products easier. The map app, large escalator and circle door would receive some focus going forward.

FIGURE 8. PLAUSIBLE IDEAS, INCLUDING SHOP MAP APP, AUTOMATED PARCEL LOCKER AND LARGE-STEPPED ESCALATOR.

The ideas that had been waiting to be put on paper, were the table with adjustable height for cafés, height-adjusting shelfing system and easy to reach freezers for shops. All of these aimed to resolve the problem of reach, which was one of the main problems for wheelchair users. The café tables were a continuation of an idea that I had discussed with one of the interviewees.

Main design tool I used, especially during brainstorming, was SCAMPER, or at least a variation of it. I firstly analyzed and distinguished features from different products and joined them together to make both potential and stupid ideas. This is a design method that has always stayed true to me and

FIGURE 9. THE BRAINSTORM SKETCHES OF HEIGHT-ADJUSTING SHELF, EASY TO REACH FREEZER AND TABLE FOR WHEELCHAIRS.

wields massive potential. The main problem tends to be deciding on what the best ideas should be further refined.

4.7 ITERATIVE DESIGN PROCESS

After the initial brainstorming, I gathered feedback from all the previously established groups and honed the ideas for the next batch of iterations. During these iteration phases, well over 50 pages worth of different concepts and variations of them were drawn.

The iterations on the ideas of the initial brainstorming session included many interesting concepts including elevator trucks, transparent escalators, and feet operatable doors. Rest of the first iterations, and of the multiple new idea strands can be seen on the FIGURE 10.

Out of these ideas, the most promising ones, according to my own intuition and feedback of fellow students, instructors, and interviewees, were the

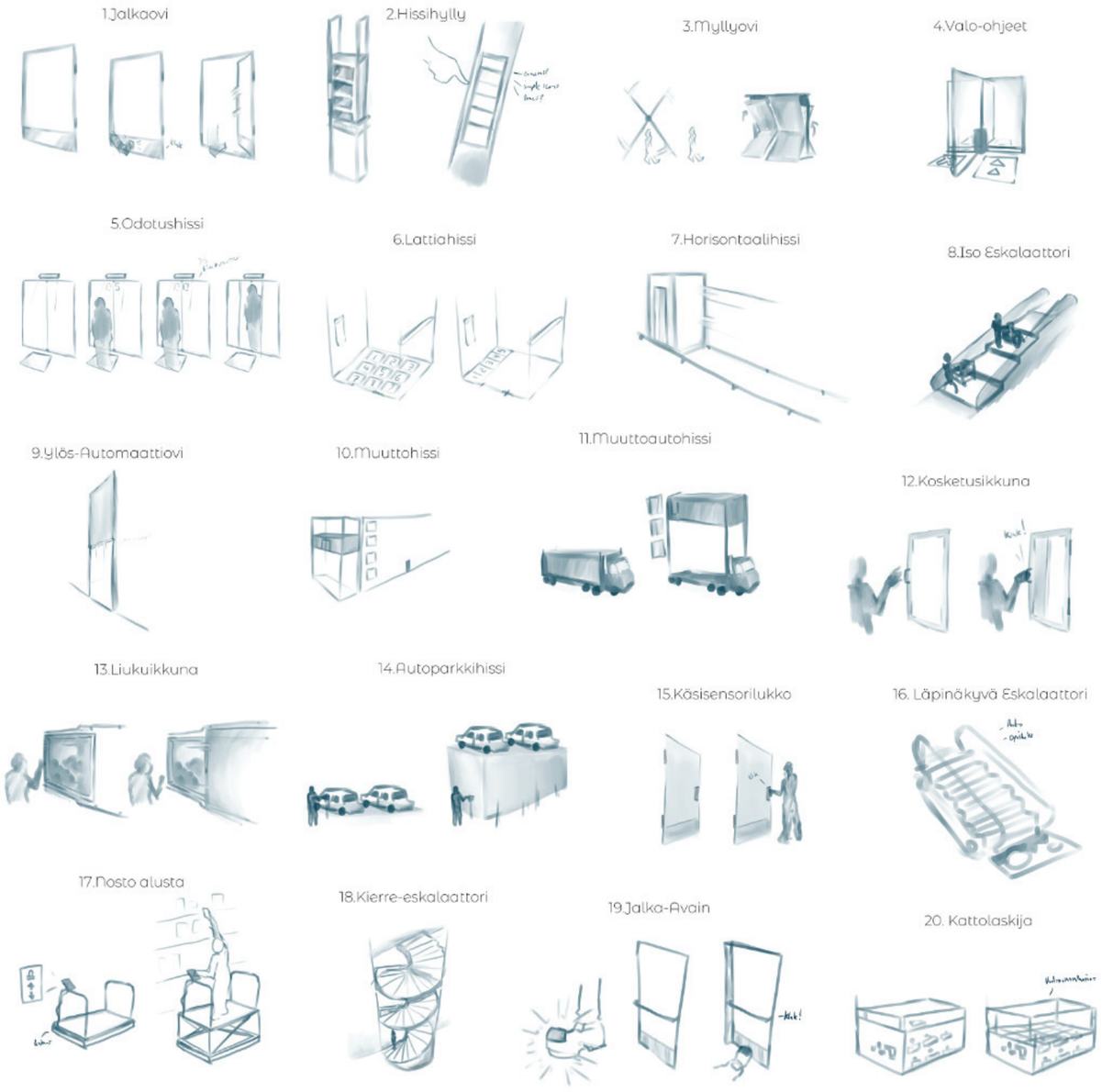


FIGURE 10. THE FIRST ITERATIONS ON THE INITIAL DESIGNS.

different variations on elevators, the height-adjustable shelves, and the enlarged escalators. The spiral escalator was also an inspiring idea to others, as it was one of the ideas other students continued to enhance.

The main entities that I focused my attention on were the elevators, escalators, and the concept of the shelf with elevating shelving units. With escalators, I wanted to find a way to make them less scary for wheelchair users. It would be beneficial to have escalators that could be used by everyone, as the main strength they have compared to elevators, excluding the higher capacity to move people, is that they are located at the main passageways unlike elevators.

While most of the design process focused on elevators, escalators, and shelving units, there were also one-off concepts explored like floor pavements. I came up with an idea for illuminated floor pavements. People with visual impairments can often see bright lights, so it seemed like a good and plausible idea. While working as floor guides, they would also look cool and give locations unique and memorable appearances.

4.7.1 ELEVATORS & ESCALATORS

On the first patch of ideas after the first round of iterations, I proposed an elevator escalator design. It would have lowered the capacity escalators could move but could make it safer for wheelchair users. That was a trade-off that made sense to me. And I was not the only one to think this way; as I showed my concepts to the wheelchair users, it appeared that such a design already exists.

I found a few enhancement concepts I thought promising for elevators. Implementing AI elements seemed like a perfect fit, as it could be used for facial recognition, voice controls, even for full automation. Such elevators could be used in housing for people with disabilities. Most of the features would not need to be AI based, but having it mentioned could accumulate more interest. I was playing with the idea that the elevator could be operated by an AI elevator operator. I was rather interested in the possibilities of that, but was noted that elevators are more tools than experiences from one the interviewee. People for whom such an operator would be most beneficial, would be the ones not to care too much about such an implementation.

The second real elevator submission was a design for an elevator designed specifically for the blind. It would have had floor guides on it, which would be helpful for everyone trying to find the elevator, large control panel with braille, high contrast floor and illuminated floors to make it easier for visually impaired to comprehend the space. It would have also had sound notifications for floors so the floor reached would be easily tellable by everyone.

The third elevator design was more of a wild card than anything else. During the initial brainstorming session, I saw a fellow classmate's concept of a spherical elevator and thought it could have potential. I drew up a few ideas, but was not able to figure out a way to make a realistic design idea from the concept. The spherical, and especially circular form has unique strengths, but their value is dissolved due to the space requirements compared to the more standard box-shaped elevators.

I started to combine the ideas I found the most potential but also extracted the main strengths from some of the previous designs. The main fusion idea was the combination of the AI elevator design and the blind elevator. It combined the strengths of both preceding designs and was the amalgamation of the best ideas I had for elevators. At this point I did not see how I could have advanced the design further and left it be. I was heavily discouraged to continue with elevators. One main reason was that for example, Kone has had people who have specialized for elevator design for decades, would they

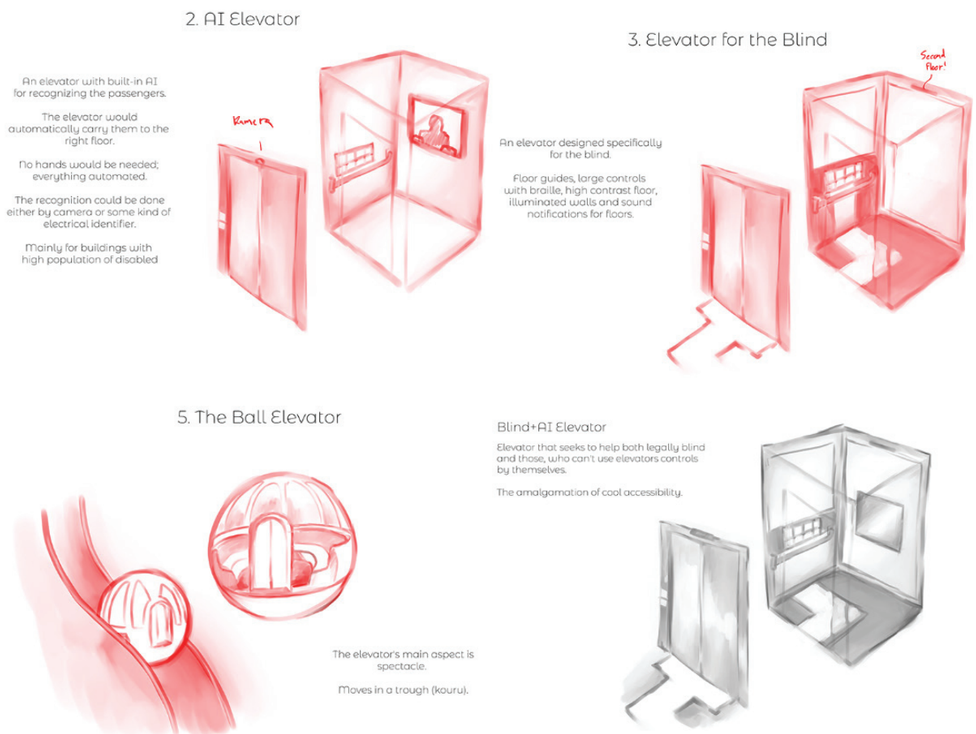


FIGURE 11. ELEVATOR CONCEPTS.

not have implemented such innovations already were they found useful.

4.7.2 SHELVING SYSTEMS

During this phase of development, my ideas with the elevating shelving unit were mainly designed with grocery stores as their main location. There were plenty of different ideas, both in how the elevating would work in physical space, but also how they would be controlled. An idea of a mobile app solution came up, which would have had grocery lists, shop maps, bonus cards, elevator controls and other useful features implemented in it.

As the deadline started to loom ever closer, I was starting to get tunnel-vision with the elevating shelving unit and was trying to force it to work. Even though I had tried my best not to fall in love with one of my initial ideals, I had failed not to. Luckily for me, the idea I was working with, was not unworkable and without its redeeming qualities.

The implementation of carousel elevating system for library shelves is a major contender for one of the most potential ideas I had during the design process. It would have been good for reachability purposes, but also for the storing capability. One main problem that kept bringing up with the shelving concepts was how would one know what is behind the outer layer of shelves or below the floor. This would have easily been dealt with ordering by alphabet as libraries do.

Main drawback for the design were the trends; is it good to spend resources on a media such as books, that are fated to fade into obscurity. Other points against it were the fact that libraries are already

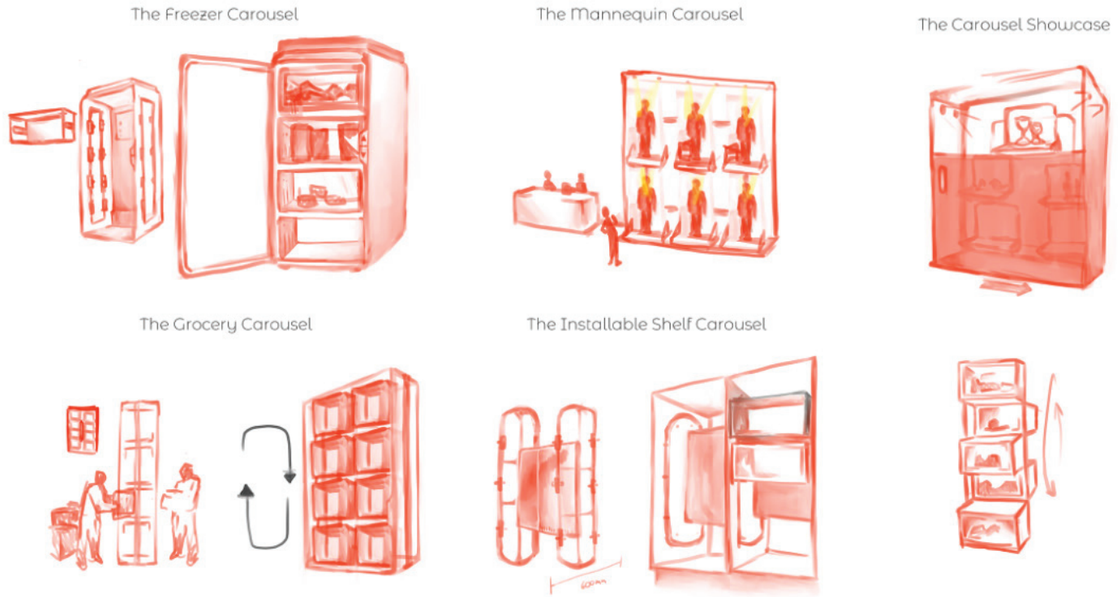


FIGURE 12. CAROUSEL AND FERRIS WHEEL SHELF CONCEPTS.

very accessible, thanks to both online loaning systems and helpful staff.

I started to vary how the problem of elevating should be approached. I realized that I would not have to re-imagine the whole self. It would be enough to have an implementation that could enable pre-existing shelves to change use heights.

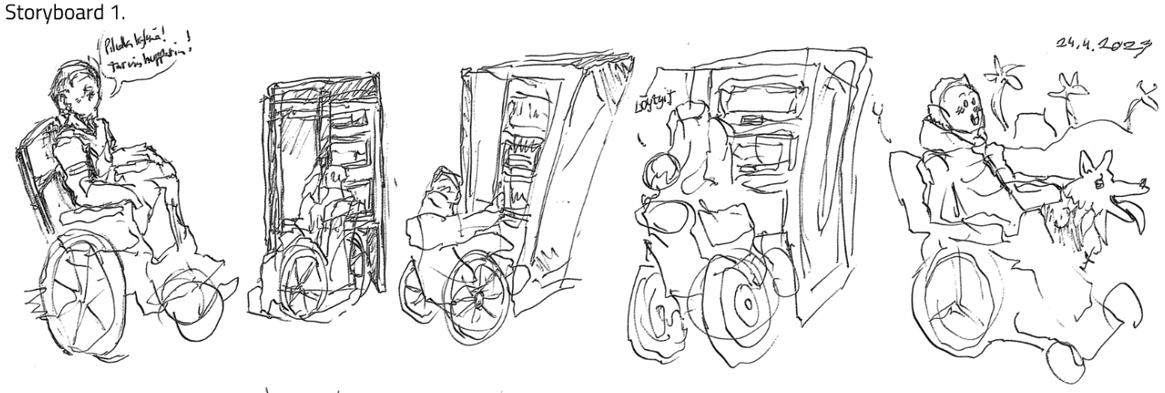
The next batch of ideas was filled with ideas regarding the elevator shelving unit. The main questions were: what could it be used for and what mechanical implementations would make such a design possible?

During this iteration patch, I started to try to implement the elevator shelf idea more liberally to different locations. Could it be useful in other shops than grocery stores, perhaps at clothing stores? A concept I made had mannequins rotating on a Ferris wheel -like system. It could be a way for a store to gain interest from shop goers. The main problem with the idea was that while it would have made for an interesting experience for end-users, the accessibility benefits would have been close to null.

The same applied to the carousel showcase unit: while it would have made it somewhat easier to store decorations on it, the miniscule accessibility benefits would have been greatly outplayed by the costs. A rotating showcase would be cool though.

Fridges are cool too, but it was one of the reasons they did not end up as the final location for the shelving unit as the operational reliability could have been uncertain. Fridges are also one of the objects which improvements were made unnecessary by the fact that many wheelchair users have helpers. They would not often be the ones to make food, so having a refrigerator with carousel functions would be, at best, a niche product. One of the main strengths a carousel shelf could have when compared to regular shelving units is the capacity, which none of the above designs would draw from.

Storyboard 1.



Storyboard 2.

FIGURE 13. ROUGH USER STORYBOARDS.

Besides the designs, which rely on different uses, I also went back to the idea of implementing the elevating shelving unit into existing shelving spaces. At this point of time, it was my favorite idea: a shelving unit that could be used in any closet or pre-existing shelf. The main reason I left it was a comment about how it would be a difficult product to sell.

At this point of the project even more different use applications were thought of. A location I had not considered before for shelving was cafés. While having other issues with accessibility, it would have made sense to make the cake displays more accessible. The main problem with the idea was that the majority of modern cafés have staff pick up the pastries for customers. Maybe the idea could work if a staff member was a wheelchair user but to enable that to be possible, many other changes would also have to be introduced to café environments.

To seek clarity in determining which product holds greater potential, I drew very rough sketches for user experience of both the options. Both seemed plausible.

The direction started to steer more towards a product for private housing as one of the interviewees stated that shelves at homes are impractical. One with disability cannot use the upper shelves or the lower ones. However, I was unsure whether private individuals would be the best target audience. Thanks to the comments of one of the mentors, I tried to make designs for stores' end shelves. That market could have been interesting in terms of money, but I failed to connect the concept with accessibility and left it be due to the rapidly closing deadline.

The home located carousel wardrobe was chosen as the basis. The final concept was starting to take shape.

4.8 NEARING THE FINAL CONCEPT

After finishing with the concept of what the product would do, the focus shifted to the question of what it could look like. I was confident in my skills to conjure up an interesting visual design for the shelf. The main problem with the design were the doors. How would they work, what would look nice? The design had for the longest time roller doors thanks to the unique visual properties they have but their usage was called into question due to usability issues.

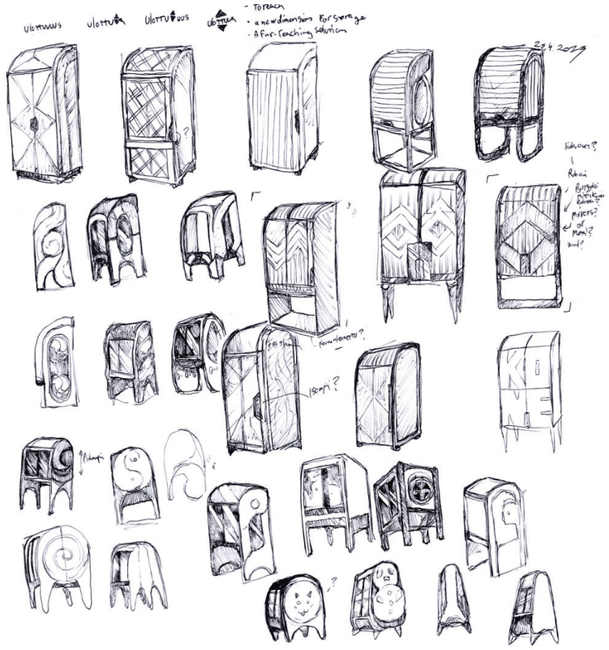


FIGURE 14. SOME OF THE VISUAL DESIGNS DRAWN WITH BALLPOINT PEN.

As the appearance of the concept was a very interesting and challenging question, traditional drawing proved its worth once more. Many different designs were drawn, most somewhat safe ideas, while others were more experimental.

The legroom under the cabinet was questioned, would it be enough of a merit for wheelchair users to use in straight facing position to lose on so much shelving space. Finally, it was decided that the legroom would stay as it would also make the products silhouette more interesting and recognizable. Another idea that was considered, was to make the product wall mountable, but it looked too much like a generic kitchen cabinet at that point.

One important aspect was what type of door would be easiest to use for wheelchair users. Would it be preferable to be movable to side-to-side or up-and-down? For reachability issues side-to-side doors would be preferable and as wheelchair users are used to sliding doors in their apartments, they would be a natural fit.

From existing shelves, cabinets and closets, I found reference materials from Pinterest for what I had in mind. I tried to find more exiting references, but as there was already a quite clear idea of what the product would look like, there was no need for more visual references. And even though the visual quality would be one of the selling points for the product, truly unique visuals were not needed as one of the main goals was that the product would be easily recognizable as a shelving unit. The main problem that I was trying to solve with the appearance, was the connection to elevators and more precisely, to Kone's designs.

The silhouette of the product was already recognizable, so there was no need to change it. I decided to model the product in SolidWorks, a 3D design software, as the design was not exactly difficult to model. The most important function the initial model had, was to make the reality of the different measurements more easily understandable.

After countless hours of concepting, I ended up with three different main visual designs. Showing intended functionality was somewhat tricky. Differently colored wood and varied wood patterns were the main ways to show those. One can see arrows pointing up and down, to evoke a sense of elevators, and escalator's belt. The design 1. had a

lot of metal on it, to tie it more to the elevator theme. It would have been a cumbersome amount, and would most likely not have fit most living spaces. The design 2. was the only one at this point to have roller doors, the other two had more basic sliding doors. On the design 3. the doors were the kind that fit on top of another, which would have blocked half of the shelf's door opening. It also had metallic outer support beams, that are often seen in the simpler designs I have made.

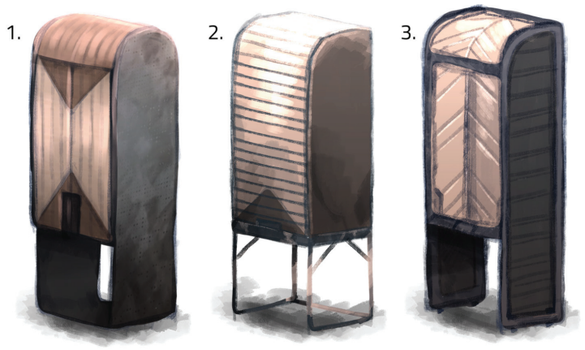


FIGURE 15. THE THREE DIFFERING CONCEPTS FOR VISUAL DESIGN.

As I started asking colleagues and friends for their opinions on the designs, the main concern seemed to lie within the design number two. With thin looking metal bars it looked unstable and likely to topple over at any time. The colors also got a lot of attention. This was the first time I had introduced lighter, warmer color schemes to them.

After applying all the planned features, I imported the model onto Keyshot, a 3D rendering software, where I started to contemplate on the materials and the final color scheme. First, I attempted to make the design with warm colors, like brown and gold. Fortunately, I had a meeting with a carpenter friend of mine, who told me about the then current trends of furniture, and as it turned out, darker, less saturated, woods were in. For the next step, I changed the colors.

4.9 FINAL CONCEPT

The final design was a sleek dark unit, with dark ebony finish, with metallic support structures giving it an easily readable appearance. The control panel, voice activation elements, Kone's logo and inner metal beams to make it more readable were also added at this point. On the FIGURE 16. one can see how the shelves would be in the final product, and what kind of a track they would move on. The visual language of the product strived to be something in between of cozy homely feel and one of cold industrial sensation.

The height of the unit had been changing during the development, but it was decided that it should be the maximum that would easily fit most of the current apartments in Finland. The width of the unit was made not only to accommodate the most prevalent closet size, but to also enable most manual wheelchairs to roll easily under it for ease of use. The depth followed the same principles.

Finally, I named the concept as Uulo, a combination of two Finnish words, uusi (new) and ulottuvuus (dimension/reach). I wanted the name to be easy to say for Finnish people for the voice activation, but I also did not want it to be a common name or a word, as that would end with many unintentional activations.

The voice activation system was a last minute attachment to the concept. It was mainly added to enhance the comfort of using the product, but it also allowed small new user groups to use the product. At this point the product would have all of its three different use mechanics; manual use, buttons on the system to rotate the shelves, and the voice commands.

FIGURE 16. THE FIRST PAGE OF PRESENTATION MATERIALS.

4.10 PRESENTATION MATERIALS

After finalizing the concept, a need for presentation materials for the judges of the competition arose. Firstly, a three-page presentation was designed, with the first page having the best-looking render and the core sizes of the product. The second had the user experience storyboard and the final page the story of how the design came to be. The page layout stayed the same until the end, except the third page which was split in two as there was way more material than one page could have possibly contained. All the pages would also have text on various features and happenstances regarding the concept.

The first page was easy to handle, and thanks to the renders I already had, became very clean. It is easily the most aesthetically pleasing page in the presentation.

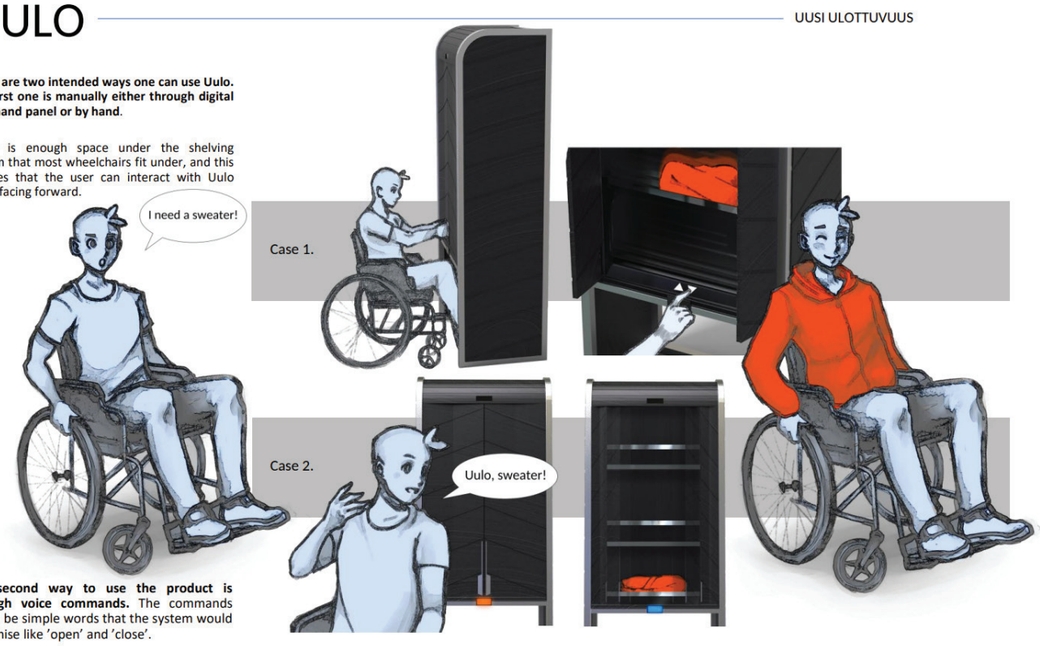
The second page was more problematic. I had drawn the quick storyboard for the product before, but as more features had been introduced, it was no longer accurate to the current concept. I made a few quick ideation sketches, which I chose one of and continued to iterate on it until it was ready. Similar to why I wanted to create a 3D model to showcase my skills, I opted to create the final storyboard with drawings. Either storyboards with stock 3D-models or just stock pictures could have worked fine,

UULO

UUSI ULOTTUVUUS

There are two intended ways one can use Uulo. The first one is manually either through digital command panel or by hand.

There is enough space under the shelving system that most wheelchairs fit under, and this enables that the user can interact with Uulo while facing forward.



The second way to use the product is through voice commands. The commands would be simple words that the system would recognise like 'open' and 'close'.

The shelves would have names. If one were to shout the name of an item they were looking for, the system would automatically transfer the wanted item/shelf to optimal height.

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FIGURE 17. THE FINALIZED SECOND PAGE.

but with the extra effort the page became neat and easily understandable.

As the text written on the competition's main page implied that they would be interested in how the concepts were created, an idea was introduced to make a page that would showcase most of the ideas created during the competition. This proved to be difficult, as there were way more potential materials than one could use, even when doubling the page amount. Telling about the process in few words was also problematic, but the following pages turned out to be fine enough for their purpose.

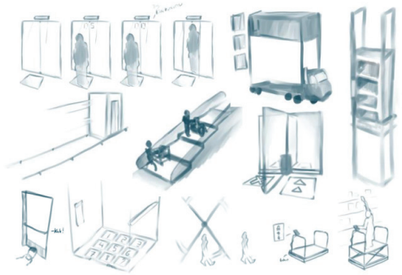
UULO

UUSI ULOTTUVUUS

The theme of 'cool accessibility' seemed extremely wide, so narrowing the field was of utmost importance. Through interactions with fellow students and other contacts, it was decided that the focus should be on wheelchair users. The contacts were able to introduce **three amazing interviewees** who all had different experiences of using wheelchairs. They were the main driving force behind the design.

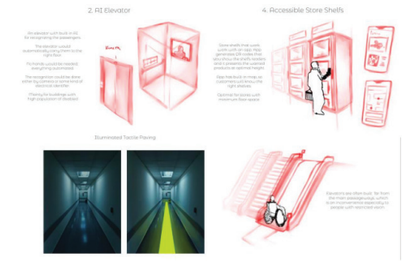
In the first interviews the main question was 'what breaks the flow in everyday situations?' The following interviews focused on discussing about concepts and whether the designs would be meaningful. One of the interviewees gave the project it's call-to-action: '**accessibility for the people with disability is accessibility for everyone'.**

During this time the concepts were somewhat adventurous, as the specific problem was yet to be chosen. This can be seen in concepts like horizontal elevator and mill door. Only the concepts that were introduced to others were drawn digitally. Most of the concepting was done traditionally.



The **decision to settle on the issue of reachability** came after a quick remark from one of the interviewees. They told of how they were not able to use the top or bottom shelves of their shelving system. The idea of elevator shelf had been there from the start, so it quickly became the main focus.

The shelving systems were not the only solution for the reachability issue. Some ideas among many were products that elevated the user. These were sidelined due to them being scary to use, especially for wheelchair users.



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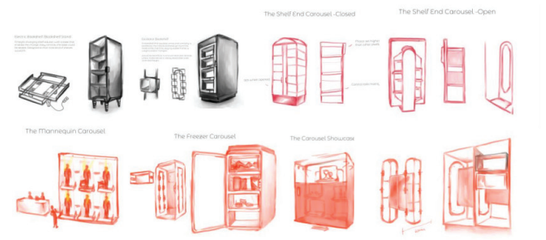
UULO

UUSI ULOTTUVUUS

Vertical carousel shelving system was the most interesting and promising as a consept. There were countless different contexts and systems it was concepted onto.

The concern of whether the product would have enough similarities with Kone products was starting to emerge. The existence of paternoster lifts with their similar concept reduced some of that.



As it was decided that the product was for home use, the process went ahead smoothly and all the promising concepts were turned into one.

The visual language was sought to be in between of pure industrial, and comfy furniture designs. It was also deemed important that the product would somehow reflect the visual language of Kone products.

The final design should have visual similarities both with elevators as well as escalators. Metal and wood were chosen as the materials to enhance the resemblance, but also thanks to them being eco-friendly materials by being durable and reusable.

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FIGURE 18. THE MAKING OF UULO -PAGES.

5. ANALYSIS

The final product was an amalgamation of many different decisions. Some of them were good whereas some might be a bit debatable. In a process to better understand the decisions made during the process, the next section will focus on analyzing different parts of the process and classifying them as positives and negatives. The negatives shall receive extra attention; they will be reviewed with the intention of finding answers to questions like how it could have been done better and how one would avoid such situations.

5.1 POSITIVES

The initial ideation worked well. I was able to produce a plethora of interesting ideas that also sparked the interest of others. The ideation methods were well chosen for the project.

I was able to find an amazing environment for the process, which enabled me to share my thoughts on my designs and receive feedback in return. The accumulation of everyone: the mentors, fellow students and the interviewees all allowed me to give the design process my best.

Speaking of the interviewees, working with them was a blast. Finding them was relatively easy compared to how impactful they were to the design. They all gave important perspectives to consider and were eager to help and share their experiences and ideations. The interviews were success in on themselves, but they were also successfully integrated into the process.

The idea for moving shelves came straight from the experiences of difficult to use shelves, and especially from the dismay that wheelchair bound people are not able to use the shelves that are too low or high. Similar shelving units already exist, but they are not aimed at promoting accessibility. I do think the concept has vast amount of potential.

One aspect I am confident about is my ability to give products believable, functional, good-looking modern visual aesthetics in a short amount of time. This case was not an exception, and I am satisfied with the final aesthetics of the design. Thanks to the symmetrical design, the product would be as easily operated by left-handed as right-handed.

5.2 NEGATIVES

The abundance of ideas should be a positive aspect for any project, but it ended up as an obstacle this time. Many of the initially pitched ideas were received with enthusiasm and positivity, which made choosing between them difficult. Due to this, the choosing process was prolonged and the decision on what to focus on came relatively late to the design process. This negatively impacted on the time available to hone the main idea, and to make sure it fit all the requirements.

The design had three different requirements: to promote accessibility, to be cool, and to fit the designs of Kone's existing product catalogue. While it could be said that the first two were somewhat of a success, the similarities the final product shares with Kone's products, both visually and mechanically, are only skin deep.

Returning to the aforementioned promotion of accessibility, did the final product design actually manage to hit that note successfully? While it was ideated on the terms of the wheelchair users, the chosen final product might not have been the most ideal. Shelving was a clear product to improve, as not only did the main focus group have limitations while using them, so did many others. Many individuals who were of average height or shorter voiced their need for an improved shelving unit as the height of the highest shelves causes problems.

Wardrope was chosen as the focus thanks to many beneficial aspects it had. In Finland, the wardrobes, as well as pantries have standard sizes, so it worked perfectly as the basis for the design. During the time the focus was decided, the concept of a shelving systems that would fit inside the standard sized closets was the on the forefront.

It was also chosen as people tend to have a lot of clothing, and the carousel shelving systems main benefit was its capacity which would have enabled one to have all their clothing in one place. Wardrobes are also so common that every household has them, and it would have been a direct upgrade. It did seem like perfect fit.

But this is the point where extra interviews should have been conducted. I was under the impression that carouselling the wardrobe would definitely be beneficial to wheelchair users, but on a later interview this thought of mine was bashed. I was told that there are ways that one can use a regular wardrobe even from a wheelchair. Wheelchair users wardrobe consist of only hanging racks, which they can easily take their clothes from by hand, or with an extending arm. This revelation came in such a late stage of the design process, that it was stuck with the existing concept.

As stated before, at the later stages of the process I should have conducted a lot more interviews. Not only a few extra but several. This is due to the time between iterations growing shorter. That caused the need for feedback to increase. I also wonder if I should have focused on one of the interviewees more than the others. While every one of them was eager to help, the feedback from one of them was more productive than others. I didn't want to favor or bother anyone excessively during the process, but in retrospect it would have been a surefire way to stay on track. I should have prioritized the most relevant and impactful insights.

One aspect of modern design industry that I failed to include in the design process was the introduction of AI akin to ChatGPT. During the process itself, I was only accustomed to programs that were barely usable in design industry. Later, I have found out how useful proper AI programs are.

The worst enemy of any creative process is the passage of time. There is a need and pressure to output designs in a pre-meditated timeframe, but that timeframe also limits the process extensively. As a design process for a completely new product, the timeframe which we were given was shorter than what one would normally get in a professional environment. The process also got stuck in the initial stages, as the decision between the main product was not chosen properly. The last half of the process had to be done in constant haste. Due to the time limitations, literature review was mostly done afterwards.

I started the process far before I knew it would end up as the topic of my thesis. As I found information easily and my extended friend circles were a home to many awesome people I could interview on the topic, I never ran out of new knowledge, experiences nor ideas I could push forward.

5.3 INTERVIEWEES' OPINION

A good time after the main project had ended, I decided to gather my courage and ask the interviewees for one final feedback, this time regarding the final concept. As the concept had not been a mass hit within the competition, I was hesitant as I was expecting mainly negative feedback. Color me surprised as most of the feedback ended up being overwhelmingly positive.

The main positive point on the concept was the fact that it had truly been designed with wheelchair users in mind with the design process hugely involving wheelchair users. During the final feedback session, and to some extent during the project, it became clear that some of the wheelchair users felt that many products aimed at them were created with only book-knowledge, not really knowing what they need and appreciate as end-users. Involving them in a design process felt important to them, and something that should be industry standard.

Somewhat ironically, the book-knowledge was also appreciated in the form of following the standardizations of measurements. The height, depth and width of the product all felt appropriate. The added plus was that if one was not to find the base use height optimal, it would be easy to adjust.

The decision of making a home product instead of a public one was also greatly appreciated, as they felt that there doesn't exist too many products that take their needs into account in their homes, excluding the height changing kitchen features. They mainly use the same products as non-wheelchair users, which are not always optimal for their use.

One reason for this design choice is the fact that wheelchair users have helpers, and the accessible homes are built with having their existence in mind. While that is great, the helpers are rarely there full-time and wheelchair users' accessibility is reduced when they are not around. Using a crucial product, like wardrobe by themselves, and failing to successfully do so, may in the worst case limit their potential in everyday live and lessen their sense of independence.

The promotion of the sense of independence was one of the more positive points made towards the concept. It would enable many people to use a wardrobe by themselves, who may not have been able to do so, or may have had hindrances in using a traditional one. Having tasks one can do by themselves is very important for one's sense of independence.

The existence of helpers was also a plus for the location choice. As wheelchair users tend to have helpers more often with them in public than at home, the existence of such a product in public would not have been seen as important.

The concept and the concepting process did get a few suggestions for improvement from them. A physical prototype would have been greatly appreciated as it would have made it possible to really establish whether the concept would have been optimally sized and whether it would be truly easy to use. Including a prototype phase to the competition timeline would have proven to be problematic though.

A simple prototype made from cardboard might have been possible in the given timeframe. But having the interviewees to test it would have been a considerable investment of money and time, as they all live in different cities across Finland. A group meeting to test the product at the campus could have been an interesting experience both for the interviewees and me. Maybe the use of an interactable 3D-model and VR-glasses could also have been used?

A prototyping phase would have been the next step for the concept. Having a prototype would also have answered to another question that came up a few times; the usability of the doors. The doors were designed so that they would not obstruct the use of the product, but also so that they would be easy and light to use, with no need for vertical movements. The final concept's doors should be operatable easily by a person in wheelchair, but this is difficult to truly confirm without a prototype.

The visuality of the product is a question with a lot of subjectivity to it. While others found the visual finish very nice, others would have wanted more variations to it, even if only through different color choices. The common color choices in décor, white and the plain wood were brought up. I was so focused in creating one color-theme, that I had totally forgotten to create other options.

Another improvement suggestion the concept got, was the possibility of customizability. As there exists many sizes of wheelchairs, the ability to customize the sizes of the product would have been greatly appreciated. The capacity of the product was also questioned thanks to the space the legroom would need, which was otherwise a great feature.

As customizability would have made the concept potentially a lot more difficult to produce, and way more complex I was hesitant with the feedback, but a collection of a few differently sized versions with different features would not have been a bad idea. That way the product could accommodate the needs of its main userbase, manual wheelchair users, but also better cater to the needs of electric wheelchair users and not-wheelchair users at the same time.

In the end, the concept got way more positive feedback than negative, and many interviewees joked about when is the concept going into production and whether they can buy one in the future.

5.4 FOUR CRITICAL POINTS FOR INCLUSIVE DESIGN

Thanks to the thesis project I have had a chance to work with amazing people. It was thanks to the involvement of the interviewees that I was able to create what I created. While working and talking with them I made an observation that there are a few guidelines one should follow when creating for a special needs group whose needs the current design norms do not take into account entirely. I have listed four critical points that should be noted:

- ACCESSIBILITY IS THE BASIS FOR EVERYTHING.

Accessibility and by further extension usability and ergonomics all play a huge role when designing for anyone. That does not change no matter who you are designing for. Knowing the basics of accessibility will take anyone's designs to the next level.

- IT IS IMPORTANT TO HAVE CLARITY ON WHO YOU ARE DESIGNING FOR.

It is very important that one should always know and focus on the needs of the groups they have decided to design for. These needs should be put above anything else. A question where this was strongly reflected in the Uulo concepting process, was the inclusion of legroom. Even though it was detrimental to one of the design's main strengths, capacity, it was still a very important inclusion for the main userbase.

- STANDARDIZATIONS EXIST FOR A REASON.

Information and measurements already exist and should be used. These might not be true if working

with a remarkably rare condition, but the existing standardizations appear to be at least somewhat comprehensive. Their existence will save designers from a lot of headaches. In Uulo's case, this was once again apparent with the legroom, as it was designed with the standardized measurements in mind.

- INVOLVE THE PEOPLE YOU ARE DESIGNING FOR.

This is easily the most important part. Even if one has accumulated information about something, but never gathered information from and worked with the populus they are designing for, they most likely will miss something that just simply meeting with the target audience would have made apparent. Having real conversations is more important than knowing your standardizations.

6. RETROSPECTIVE

The thesis process ended up being more prolonged than I personally had anticipated. Even though I had chosen a project that I had a lot of personal interest in, having to juggle between challenging work that requires constant learning and self-improvement and writing of a thesis that felt like a never-ending nightmare was tough. A substantial gap on working on the thesis happened when learning that my concept did not win, and I used a lot of time on self-searching and retrospectively reviewing the whole process and where I "went wrong."

After the retrospection, I did find out that I never went wrong with my methods. While the concept was not iterated into perfection, it was all due to the time-restrained environment. But even though iteration time was cut short, the final concept did what it did well and was good enough on most aspects.

As stated before, I Initially had other ideas for my thesis. Retrospectively, I am very happy I ended up deciding to base my thesis on the competition, even though it had its own problems. I was lightly instructed by an instructor who had done the same decision in the past, that competition might not be the most optimal base for a thesis there could be. Nevertheless, I decided to base my thesis on the Cool Accessibility -competition, after I had met with the interviewees. They gave me confidence that I could create something unique during the competition.

Having a considerable time gap between creating the concept and the main bulk of the writing phase might have been a blessing in disguise. It allowed me to see the choices made before more clearly. It also distanced me from the project so that I could review the project from somewhat more objective viewpoint. Had I only written about the project as it happened, I would have been unable to benefit from the thesis as much in the way of professional growth as I did.

I enjoyed working with the end-users. Working with them led to a positive environment, where one could come up with truly useful designs, instead of just creating random things for the sake of consumerism.

The decision to go with English as the language for the thesis led to many favorable outcomes. During my education of design, I have mainly been familiarized with Finnish terms and localized materials, so having been able to study the field's literature in English enabled me to greatly broaden my view on design and its elements. It also helped me to find more legitimate sources, without having to translate every term back to Finnish. If there were terms that proved to be more problematic in English, they were 'accessibility' (esteettömyys) versus 'accessibility' (saavutettavuus.)

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LIST OF FIGURES

APPENDIX 1.

Interviews:

Interviewee 1: Master of Education

Interview 1 27.1.2023

Interviewee 2: Wheelchair User 1.

Interview 1 2.2.2023

Interview 2 29.3.2023

Interview 3 4.3.2024

Interviewee 3: Wheelchair User 2.

Interview 1 7.2.2023

Interview 2 21.3.2023

Interview 3 27.3.2024

Interviewee 4: Wheelchair User 3.

Interview 1 9.2.2023

Interview 2 13.4.2023

Interview 3 27.3.2024